

Patterns in conversations between mothers and children with and without specific language disorder

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Abstract

Mothers are an important part of children's language environments, and are assumed to play a role in their children's language development. This exploratory study investigates the maternal responses in groups of children with and without language impairments, especially related to the intelligibility and errors in the child utterances. Analyses of child-mother sequences indicate that the mothers of children with normal language and children with suspected or diagnosed language disorders show the similar patterns of responses. Mothers of children with a suspected or diagnosed language disorder, however, interpret and ask clarifying questions to preceding child utterances more often than what mothers of children with typical language do. The tendencies for group variations are related to unintelligible child utterances. It is argued that facilitating maternal responses naturally occur in all dyads, and that this is interdependent on the different language productions of their children.

Keywords: language delay, maternal responses and sequential analyses.

In most cases, language acquisition proceeds in an unproblematic manner (Bates, Dale, & Thal, 1995; Tomasello, 2006). Within the range of normal development, there are considerable individual differences in language outcomes (Bates, et al., 1995; Beeghly, 2006; Nelson, 1973). Among preschool children, 5-10 percent have delayed language in a degree that classifies for a language disorder diagnosis (Archibald and Gathercole, 2006; Bishop & Leonard, 2000; Leonard, 1998; La Paro, Justice, Skibbe and Pianta, 2004). Usually children with language delays are identified during their preschool years (Broomfield and Dodd, 2004; Tager-Flusberg and Cooper, 1999).

Developmental language disorders are divided into receptive-expressive, expressive and phonological impairments in DSM IV (American Psychiatric Association (APA), 1994). Receptive-expressive impairments are considered the most severe and phonological impairments the least severe. When children with language impairments have cognitive abilities within the normal range, the term specific language impairment is often used (Bishop, 2002; Leonard, 1998). DSM IV criteria for a diagnosis, also involves exclusion of pervasive developmental disorder, hearing impairments or several incidences of middle ear infections with fluid accumulation. The male-female distribution range from 2:1 to 3:1 (Heim and Benasich, 2006), and girls generally have less severe impairments (Leonard, 1998).

In concurrence with transactional theory, environmental factors may both reduce and increase the effects of impairments over time. These conditions have also been labeled “positive and negative feedback systems” (Sameroff and MacKenzie, 2003, p. 616). The presence of language delay is assumed to affect the relationship between the children and their surroundings in several ways. Children with language delays have less complex and intelligible speech and make more linguistic errors (Leonard, 1998). It has therefore been presumed that primary caregivers might have difficulties with responding to the children’s language productions compared to parents of peers with normal language (Bates, 2004; Camarata and Yoder, 2002; Conti-Ramsden, 1994; Girolametto et al., 2002; Snow, 1995). The children’s linguistic initiations and responses are suggested to be very important, because this is what call forth responses from the surroundings (Camarata and Yoder, 2002; Liiva and Cleave, 2005). Furthermore, receptive and expressive language impairments may affect the children’s ability to utilize their linguistic experiences and these children may therefore have different input needs than peers without language delays (Conti-Ramsden, 1994; Yoder, Klee, Hooshyar and Schaffer, 1997; Yont, Hewitt and Miccio, 2002). Child-dependent maternal responses could therefore, at least in theory, reduce or increase the effects of impairments and play a role in the persistency of language delay (Dale, Price, Bishop & Plomin, 2003).

Child Directed Speech in Normal Language

Parents adjust their quantity and quality of speech to the cognitive and linguistic level of their children. This is also referred to as “*child-directed speech*” (Pine, 1994; Snow, 1995). Such strategies may simplify the language input (e.g. slow pronunciation, phonological exaggerations, simplified vocabulary and syntax; Corsini, 1999), which makes it easier for children to understand. Speech directed at children may also provide appropriate structural, as well as pragmatic language models and corrective feedback (i.e. add what’s omitted and correct what’s wrong; Bohannon and Stanowicz, 1988; Saxton, Backley and Gallaway, 2005).

Several studies have addressed the effects of varying amounts and qualities of child-directed speech on child language development in populations of children with normal language (Hart and Risley, 1992, 1995; Nelson, 1973; Saxton et al., 2005; Tamis-LeMonda, Shannon, Cabrera, and Lamb, 2004). In a study by Hart and Risley (1992; 1995), children in 42 families were followed up from about six months until the age of three years. During this period, the amount and quality of the linguistic input that the children received from their parents were monitored, as were the children’s language gain during the period. From 29-36 months the number of utterances addressed towards the children on a daily basis ranged from 34-783 per hour. Rate of words that parents addressed to their children was strongly related to the rate of child vocabulary growth in the period and to child vocabulary at age three. Moreover, the rate of parents’ speech to their children showed a strong and positive relation with socioeconomic status. From birth to 36 months, children of middle class parents would have heard on average over 6 million words compared to 3 million for children of poor families.

Another socioeconomic variable that has been correlated with child language is maternal education. Mothers with high education have appeared to have children with significantly higher vocabulary than mothers with lower level of education (D’Odorico, Carubbi, Salerni and Calvo, 2001). High educated mothers sometimes show more demanding and challenging strategies when in conversation with their children than mothers with lower education, and this may explain the positive relations between maternal education and child language measures (Fidalgo and Pereira, 2005; Hammer, Tomblin, Zhang, Weiss, 2001). Varying maternal conversational style suggests that the difference in language abilities between children of mothers with high and low education is not caused by inherited language abilities (Tomasello, 2003). Saxton et al. (2005) found an effect of maternal replies that corrected grammatical errors in child utterances on acquisition on some grammatical

structures. Since it has been difficult to detect any long-lasting effects of child-directed speech on the language development of normal children, some researchers suggest that once a threshold of environmental input is fulfilled, individual differences in input do not have any effect on typical language development (Girolametto, Weitzman, Wiigs and Pearce, 1999).

Child Directed Speech in Mothers of Children with Language Delay

Research on child-directed speech has been adapted to studies of children with language delays, which generally have focused on play interactions between mothers and their children. The mothers and their language-delayed children are typically observed in the home-environment or a clinical setting (Bornstein, Hayne, Painter and Genevro, 2000).

Several studies have addressed the question whether mothers of children with specific language impairments are less responsive than what mothers of peers with normal language are (for reviews see Conti-Ramsden, 1994 or Leonard, 1998). The term *maternal responsiveness* implies that there exist differences in how mothers of children with and without language delay respond to their children's language. If mothers react less frequently, it may be related to how much child language they have an opportunity to respond to (Conti-Ramsden, 1994). It is especially distinguished between maternal responses that are *topic continuations* and *initiatives* of new topics (Nelson et al., 1995). When replying contingent to the topic and focus in the prior child utterances, mothers may also *elaborate* on the semantic content of the child utterances (Nelson et al., 1995; Vigil, Hodges and Klee, 2005).

In a large-scale study by Hammer et al. (2001), restrictive and task-teaching child-rearing practices of mothers detected through a questionnaire were positively correlated with children's status as language delayed. It was claimed that the mothers had altered their child-rearing practices as a consequence of their children's functional language level.

Early studies revealed that mothers of children with specific language impairments initiated new topics, controlled and directed the conversations with their children in a higher degree than mothers of children without language impairments (Conti-Ramsden, 1990; Peterson and Sherrod, 1982). Paul and Elwood (1991) found lower frequencies of topic expansions and play extensions in mothers of children with slow expressive language development compared to mothers of children with normal language (age range: 20-34 months). But, this difference disappeared when amount of language produced by the children was controlled for. Thus, the increased conversational control and decreased responsiveness

to the children's attention focus was related to the lower amounts of language produced by their children. This result suggests that the delayed language of the children triggered the mothers' conversational style (Conti-Ramsden, 1994; Camarata and Yoder, 2002). Since decreased amounts of responses has been related to slower language development in normal populations (Hart and Risley, 1995), it has been argued that relatively low amounts of maternal responses to children with language impairments may influence the children's language development even more negatively (Camarata and Yoder, 2002).

In a more recent study, mothers of 10 children with expressive language delay had relatively fewer responses and more initiations than the mothers of 19 children with normal language (age range: 24-29 months; Vigil, Hodges and Klee, 2005). Since the amount of child language production was not controlled for, the relatively decreased amount of maternal responses to the children with language delay was considered related to the more infrequent and less complex language productions of their children. The mothers may compensate for their children's language delay through taking more conversational space and initiate topics more often (Conti-Ramsden, 1990; Hammer et al., 2001; Vigil et al., 2005).

The relationship between children's language delay and more infrequent maternal response rates has been argued to be an "*inadequate feedback-loop*" (Tannock and Girolametto, 1992 in Vigil et al., 2005). Vigil et al. presume that language delays are related to difficulties with processing information (Hick, Botting and Conti-Ramsden, 2005), which affects both language comprehension and production of speech. The increased rate of maternal initiatives would then result in more processing demands, that make it even more difficult for the children to access the conversation (Vigil et al., 2005).

Higher rates of topic initiations by mothers of children with language delays are not a consistent finding (Leonard, 1998). Other studies have not detected any group differences in the topic contingency of maternal utterances (Nelson et al., 1995), even if mothers of children with delay seemingly talk more than comparison mothers (Rescorla, Bascone, Lampard and Feeney, 2001; Rescorla and Fechnay, 1996). In one study, mothers of children with language delays showed a tendency to wait for their children to initiate new topics and reply to this, contrary to initiate a new topic themselves, when empty spaces appeared in the conversations (Rescorla et al., 2001). This result contradicts the interpretations of Vigil et al. (2005).

Even when dividing the children with language delays into those that continued to be delayed, those that had improved their language (late bloomers) and typically developing children at age three, Rescorla et al. (2001) detected only one significance group difference in maternal responses. The mothers of children with continued language delay asked more

questions than the other mothers did. The researchers argued that the mothers of the children with language delay might have developed a questioning conversational style, in order to trigger participation by the children in the conversations.

In addition to topic continuation, a mother can also provide feedback that acknowledges the semantics of the child utterance through imitation or addition of what is missing or correction of what is wrong in the preceding child utterance (Girolametto et al., 1999; Yoder et al., 1997). Girolametto et al. (2002, p. 155) argue that maternal interpretations "...facilitate the transition from pre-linguistic to linguistic communication and reinforce the child for participation in dialogue...". Maternal interpretation, imitation and expansion of the semantically content in child utterances in play interactions with 12 children with expressive language delay (mean age: 29 months) was correlated with children's expressive vocabulary 4 months later (Girolametto et al., 1999). This was taken as support for the effects of responsive language input.

The most consistent finding within the field is that mothers of children with language delay recast their children's utterances relatively less frequently than comparison mothers of children compared on age and language level (Leonard, 1998). *Recasts* are maternal responses that add content and structurally change one or more components in the children's prior utterances, and may involve reordering, reductions or expansions (Nelson et al, 1995). It is also differentiated between simple and complex recasts. Simple recasts involve changing one component, while complex recasts involve change of two or more components of the preceding child utterance. Recasts are often corrections of prior child utterances. Corrective feedback represents models of improvements of the child utterances (Saxton, Backley and Gallaway, 2005), while at the same time restricting the demands on the children's attention resources by using their preceding sentence as a platform (Nelson et al., 1995). One of the reasons that recasts are thought to be facilitating for the language development of children with language delays is that it does not impose a reply upon the child. This provide the child time to attend to the corrective adjustments, rather than spending all attention resources on a reply, which would have deprived the child knowledge about the maternal adjustments (Fey and Proctor-Williams, 2000).

Effects of recast interventions suggest that increasing maternal recast use through interventions will have important effects on the language development of children with language delay (Fey and Proctor-Williams, 2000; Yoder, Camarata and Gardner, 2005). Several intervention studies have shown that recasts improve syntactical structures (Gillum, Camarata, Nelson and Camarata, 2003; Proctor-Williams, Fey and Loeb, 2001) and the

intelligibility of children's speech (Yoder, Camarata and Gardner, 2005). Fey, Krulik, Loeb and Proctor-Williams (1999) examined the effects of a recast intervention in a sample of preschool children with specific language impairments. The children that gained most over a 5-month period received up to twice as many recasts than typical in natural interactions between mothers and children with normal language. This suggests that recasts may facilitate the children's language development. Fey and Proctor-Williams proposed that what children with specific language impairment may need is to have mothers who are "super-responsive". The reasoning is thus that children with language delays may have a need for increased recast rates compared to children with typical development to compensate for their delays (Conti-Ramsden, 1994). Conti-Ramsden (1994) argues that special children may have special needs.

Even though children with specific language impairments seem to benefit from recast interventions that target either the intelligibility or language errors (Yoder et al., 2005), what exactly that makes mothers recast their children's utterance in natural situations are yet to be discovered. Conti-Ramsden (1990) found that 14 children with specific language impairments received more simple recasts and less complex recasts rates by their mothers compared to 14 younger children with normal language development. The mothers of the children with language impairments also used recasts more to request information and direct their children, while the comparison mothers used recasts more often to ask for clarifications or answer to their children's utterances. Nelson and his colleagues (1995) found that mothers of 6 children with specific language impairments (age range: 4;9-6;7) used recasts in 19 percent of their replies to their children compared to 32 percent for the mothers of 7 language-matched children. For complex recasts, the frequencies were 16 and 25 percent. When mothers use recasts less often to children with specific language impairments than to younger normal developing siblings with similar language levels, this implies that the mothers do not adjust their recast responses to the joint language level of the children (Conti-Ramsden, Hutcheson and Grove (1995).

Nelson et al. (1995) argues that mothers adjust their use of recasts to the cognitive or chronological age of their children, since a decreasing tendency for use of recast is evident between the ages of 2 and 6 in normal language acquisition. This assumption was challenged when Fey et al. (1999) failed to replicate earlier studies of a recast gap. These researchers compared mothers of 10 children with specific language impairment (mean age: 41 months) with the mothers of 10 children with typical development matched on mean length of utterances (MLU) (mean age: 24 months). The researchers discussed whether this was related to the smaller age-difference between their groups and the younger age and less severe

language impairments of the children in their sample compared to that of Nelson et al. (1995). If the hypothesis that frequency of maternal recasts decreases with increasing chronological child age, younger children should receive more maternal recasts independent on their language abilities or disabilities. In a study by Conti-Ramsden (1990), maternal recasts correlated with children's degree of intelligibility. A certain degree of intelligibility of child speech was necessary for the mothers to have something to build their recasts on. If maternal recast rates are affected by characteristics of the children's language productions, child intelligibility could induce mothers' tendency to use recasts (Yoder et al., 1996).

Relationship between child language acts and maternal responses

Most studies within the field have used correlation analyses or investigated the general occurrence of different child and maternal utterance types. This has resulted in some indications of relationships between characteristics of the language productions of children with language delays and maternal utterances and how this pattern differs from that of children with normal language and their mothers. A few studies have more specifically looked at the sequential relations between different types of child utterances and specific maternal responses (Yoder, Hooshyar, Klee and Shaffer, 1996, 1997; Yont, Hewitt and Miccio, 2002). Using sequential analyses, they considered the temporal relationship between preceding child utterances and subsequent maternal responses (Bakeman and Gottman, 1997)

In a study by Yoder et al. (1997), a within-group variance of maternal expansions in play interactions with 33 children with language delay (mean age: 44 months) was positively related to mean length of utterances and intelligibility of their children's speech. Those children who produced the most fully intelligible multiword utterances experienced higher rates of maternal recast (the authors used the term expansion). The mothers were less likely to expand partly unintelligible or one-word child utterances. The researchers argued that fully intelligible multiword utterances elicit maternal expansions for children with language delay. Thus, they reasoned that children elicit specific responses by their mothers through specific language productions, which facilitate further language development in the children (Yoder et al., 1997). This type of processes has been termed "*eliciting bootstrapping operations*" (Shatz, 1987, in Yoder et al., 1997). The same researchers (Yoder et al., 1996) did also find a smaller tendency to use maternal recast following multiword partly intelligible utterances in children with language delay when compared to children with Down's syndrome. It was

argued that the children with language delay had less partly intelligible utterances, and the mothers were consequently less experienced with responding to such utterances.

Yont, Hewitt and Miccio (2002) also found a relationship between characteristics of child utterances and succeeding maternal requests for clarifications. The mothers of children with specific language or phonological disorders requested clarifications significantly more following their children's phonologic and pragmatic errors compared to the mothers of normal developing same-aged peers (mean age: 49 months).

The present study

Previous studies have found differences in general occurrences of maternal use of initiatives, topic continuations and recasts when controlling for child talkativeness (Vigil et al., 2005; Girolametto et al., 1999; Nelson et al., 1995). It is uncertain, however, whether the differences occur only because the children produce less language (Rescorla et al., 2001; Yont et al., 2002), or whether the mothers also respond differently when responding to same amount and qualities of child utterances.

The present explorative study focuses on the conversational patterns between mothers and children with and without language delay. Such situations can reveal how mothers and children affect each other's in the course of interaction (Evans, 2001; Rutter, 2000). This study extends previous studies by including all child-mother sequences, where maternal utterances follow child utterances. In this way, it was possible to see how the mothers proportionally respond to child utterances in general and more specifically how the mothers respond to child utterances with errors or low degree of intelligibility. The sequential analysis applied explored how often specific maternal responses follows child utterances, and whether some sequences were more typical for dyads with language impairment compared to those with normal language (Bakeman and Gottman, 1997). The hypothesis that there are differences in maternal responses to children with and without language delays was addressed. In addition, the study explored whether the mothers differ in their responses to child utterances with errors and different degrees of intelligibility.

Method

Participants

All participants are enrolled in the ongoing Autism Birth Cohort Study (ABC), which is a sub-study of the population-based Norwegian Mother and Child Study (MoBa; Magnus et al., 2006). ABC is a project-collaboration between the Norwegian Institute of Public Health, the Mailman School of Public Health at Columbia University and the National Institute of Neurological Disorders and Stroke (Revised unpublished protocol in the ABC study, April 2006). In the ABC study, children are screened for features of Autism Spectrum Disorder (ASD) at a 36-months survey from MoBa. There are five screening criteria's for which the mother must report positive behavior on at least one: 1) low score on Social Communication Scale (SCQ-33 score ≥ 12); 2) mothers reports of ASD traits; 3) mothers report of language delay and report of referral to a specialist; 4) repetitive behavior (SCQ-33 score ≥ 9); 5) mothers report worry of the child's little interest in playing with peers. (For description of selection processes, see flow chart in Appendix 1).

Around the age of 39-42 months, screened children are invited together with a randomly selected control group to take part in clinical assessments lasting for 1.5 day. The diagnostic evaluation is based on clinical assessments, interviews and medical examination, performed by experienced clinical psychologists and psychiatrists, research assistants and medical doctors. Clinical evaluations may result in diagnoses within the Autism Spectrum or other developmental disorders. A large proportion of the children receive a language disorder diagnosis or are suspected to be delayed in their language development but not reaching the level of diagnosis (APA, 2002).

By December 31st 2006, 164 children had participated in the ABC study. The present study included 50 of these children and their mothers. All dyads were Norwegian, but came from different parts of the country. None of the children were bilingual. The children were divided into three groups based on the clinical conclusion in ABC.

The first group consisted of 21 children with a language disorder diagnosis. Five of the children were later excluded, because one was suspected to have mental retardation, two were within the ASD spectrum and two due to inconsistent transcription data. In the remaining group of 16 children, twelve boys and four girls, two had phonological language impairments, eight had expressive and six had expressive and impulsive language impairments. Three of the children with expressive and impulsive language disorder also had co-morbid diagnoses

of hyperactivity, attention or impulsive problems. This group will be referred to as those diagnosed with a language disorder (*Diagnosis LD*).

The second group consisted of 7 children, six girls and one boy, who were suspected to be language delayed, even if not reaching the clinical threshold for a diagnosis (*Suspected LD*). Of these children, four had mild phonological delay and three had mild expressive delay.

The comparison group consisted of 22 children with normal language, eleven boys and eleven girls, who were randomly selected from the ABC control group (*Control*). Two of the comparison children were assigned a disruptive childhood disorder.

None of the children in the sample had a pervasive developmental disorder, neurological problems, or motor impairments at the time. One child in the Diagnosis LD group used glasses. None of the children had auditory problems that we knew of at the time.

Socio-economic status was indicated by years of maternal education during pregnancy (table 1), since educational level is considered to affect maternal responses (Fidalgo and Pereira, 2005). A higher percentage of mothers in the Diagnosis group and the Control group had up to 12 years of public schooling or had attended a University for more than 4 years to gain a professional degree. The mothers in the Suspected group had a higher percentage of University education up to 4 years. The differences was not significant [$F(2, 42)=0.16$, $p=.856$]. The educational levels could have changed by their participation in the ABC study.

Table 1: *Maternal years of education: frequencies and percentages*

	^a Up to 12 years	^b 12-16 years	^c Over 16 years
Diagnosis LD (N=16)	6 (37.5 %)	7 (43.8 %)	3 (18.8 %)
Suspected LD (N=7)	1 (14.3 %)	5 (71.4 %)	1 (14.3 %)
Control (N=22)	8 (36.4 %)	9 (40.9 %)	5 (22.7 %)

Notes: ^a Up to 12 years of schooling. ^b Up to 4 years at a University or college.

^c Over 4 years at a University or college education.

Table 2 presents the means, standard deviations and range of the children's age, non-verbal (NVIQ), verbal (VIQ) and total (TOTIQ) scores on the Stanford-Binet Intelligence Scale (Johnson, Howie, Owen, Baldwin & Luttman, 1993). IQ scores were missing for two children in the Diagnosis Group. No statistical age difference was revealed. The Diagnosis and Suspected groups had significantly lower scores than the Control group on non-verbal and total IQ measures [$F(2, 40)=6.0$, $p=.005$; $F(2, 39)=12.3$, $p<.001$]. This slight discrepancy

within the normality limits on non-verbal IQ measures reflects previous studies (Leonard, 1998). Only the Diagnosis group had significantly lower verbal IQ than the Comparison group [$F(2, 39)=15.2, p<.001$]. All the eta squares of 0.23, 0.44 and 0.63 were considered high (Cohen, 1988).

The Stanford Binet Intelligence Scale is not standardized for Norwegian usage, so there might be some limitations connected to these measures. Since this would apply to all groups, the scores were considered an appropriate indication of relative functional level.

Table 2: *The children's age in months, non-verbal IQ, verbal IQ and total IQ.*

	<u>Diagnosis LD</u> (N=14)			<u>Suspected LD</u> (N=7)			<u>Control</u> (N=22)			<u>ANOVA</u>	
	M	(SD)	Range	M	(SD)	Range	M	(SD)	Range	<i>F</i>	<i>P-H</i> ^a
Age	41.4	(1.83)	39-45	41.8	(1.13)	40-43	42.1	(1.36)	40-44	0.754	
IQ											
NVIQ	95.8	(14.15)	73-122	93.3	(6.60)	81-100	107.0	(10.70)	82-123	6.027*	DS<C ^b
VIQ	77.9	(12.63)	61-105	88.0	(12.28)	72-106	103.3	(14.58)	58-122	15.153**	D<C ^c
TOTIQ	86.1	(12.38)	68-112	90.5	(7.53)	82-102	105.2	(12.17)	71-119	12.268**	DS<C

**<.01, *<.05 level of significance.

Notes: ^a *P-H* = Tukey post-hoc comparison test

^b DS<C = The Diagnosis LD (D) and Suspected LD (S) have significantly lower levels than the Control group (C)

^c D<C = The Diagnosis LD (D) group has significantly lower levels than the Control group (C)

Procedure

The children were video recorded in play situations with their mothers at the ABC facilities. To make the situation as natural as possible, the mothers and their children were videotaped while left alone in a room with two small and neutral cameras for approximately 10 minutes. The mothers chose two different kinds of toys (i.e. clay, picture cards, Bob the builder play set, farmer figure set, a picture-book or a counting frame) and were instructed to play with their child like they normally do and change toys after 5 minutes. Buss and Plomin (1984) originally developed this situation to measure children's reactions to the change of toys.

Transcription

The author and two other students transcribed language produced by the children and mothers' using the Systematic Analysis of Language Transcripts format (e.g. SALT; Miller and Chapman, 2004). SALT provided measures of the children's mean length of utterance in

words, (which bases on complete and intelligible utterances), total utterances and percent of intelligible speech (which designates all utterances minus partly and completely unintelligible utterances). To be able to use the transcripts for further coding, contextual information was included. All transcripts were ended at exactly 10 minutes.

Codes

Subsequently, the author coded the transcripts. During this process the original transcripts where not changed, unless there were clearly mistakes that had been made (i.e. substituting a mothers utterance for a child's). In this way, the reliability of the transcription was not undermined.

As shown in table 3 all child utterances that preceded maternal utterances were included. Furthermore, *partially* and *completely unintelligible* utterances, utterances with *grammatical or syntactical errors*, and utterances with *phonological errors* were coded. These utterances were mutually exclusive. Communicative gestures were also defined as utterances. Since *very few* child “utterances” was gestures, they were kept for analyses.

Maternal utterances that immediately followed child utterances were categorized as *elaboration*, *topic continuation*, *initiative* or *other* (table 4). The first two of these categories had four subcategories each, derived from previous research. Elaboration consisted of

Table 3: *Child utterances*

Category	Description
a. All Utterances	Child utterance and communicative gesture preceding maternal utterance.
b. Partly Unintelligible	Part of utterance is considered unintelligible by the transcriber.
c. Completely Unintelligible	Whole utterance is considered unintelligible by the transcriber.
d. Intelligible with Grammatical Errors	Intelligible utterance with grammatical or syntactical error.
e. Intelligible with Phonological Errors	Intelligible utterance involving phonological error or mispronunciation.

maternal *interpretations*, *recasts*, *imitations* or *clarifying questions*. Topic continuation was divided into *continuation*, *question*, *yes-no question* or *repetition*. When elaborating completely unintelligible child utterances, the mothers either interpreted or asked clarifying questions, since recasts and imitations depend on at least partly intelligible utterances. An overview of the research variables and the connections between them are presented by a figure in Appendix 2.

Table 4: *Maternal responses*

Category	Description
Elaboration	Elaboration on the morph-syntactic and lexical content of the previous child utterance, through:
a. Interpretation	Interpretation of the intended message of the previous child utterance by using the context and intelligible parts of the child utterance as clues (Vigil et al, 2005).
b. Recast	Repetition of the word approximation of the child utterance and addition of one or several morphemes or words (i.e. simple recast or expansion) (Vigil et al., 2005). Or a change of one or more components in the child's sentence and a change of the function or modality of the child utterance (i.e. complex recast; Conti-Ramsden, 1990; Nelson et al., 1995).
c. Imitation	Exact imitation of the entire or parts of the preceding child utterance.
d. Clarifying question	Asking the child to clarify the semantic, morph-syntactic or lexical content of the preceding utterance.
Topic continuation	The maternal utterance is contingent on the topic of the preceding child utterance, but does not elaborate on what the child says.
a. Continuation	Continuation on the topic of the preceding child utterance, but do not ask a question, yes-no question or repeat a previous maternal utterance.
b. Question	Ask questions that are contingent on the topic of the previous child utterance.
c. Yes / No Question	Ask questions that prompt yes-no answers and that are contingent on the topic of the previous child utterance.
d. Repetition	Repetition of the same intentional message in various or similar formulations as previous maternal utterances within the same topic permanence.
New initiatives	New topics of conversations, games or activities introduced by verbal utterances or gestures (Ninio and Snow, 1996; Vigil et al, 2005).
Other	Utterances that do not fit the other two categories, such as self-directed speech, exclamations, and singing.

Inter-rate agreement

Twenty percent of the transcripts were randomly drawn and transcribed by two independent transcribers. Interclass correlation coefficients (ICC) for two languages measures estimated by SALT were calculated. ICC for percent of intelligibility, calculated by estimating the percentage of child utterances that were not partly or completely unintelligible, was 85.0 percent. ICC for mean length of utterances in words (MLUw), calculated on the basis of complete and intelligible utterances, was 87.5 percent.

Nine randomly selected transcripts were double coded by another psychology student. This student received approximately 2 hours of training, where the different codes got explained and exemplified. Agreement was reached whenever both coders had applied the exact same code, including identical decisions of the subcategories of elaboration and topic continuation. The percentage agreement for the different maternal discourse function categories was 72.9 (elaboration), 84.1 (topic continuation), 72.1 (initiative) and 83.3 (other). The inter-rate agreement for child utterances with either grammatical or phonological errors was 83.7 percent.

Analyses

Parametric tests were preferred due to the superior robustness compared to non-parametric analyses (Sundet, personal communication 2007). Analysis of variance (ANOVA) tested group differences of maternal responses to all child utterances and to the specified utterances. Tukey's post-hoc test indicated which groups that significantly differed from each other.

The robust tests Welch and Brown-Forsythe was applied whenever the assumption of homogeneity of variance was violated. Since these tests do not present the necessary information for calculating eta squares (i.e. effect sizes), the information from the ANOVA analyses was always used to calculate eta squares. Even if this does not take into consideration the adjusted degrees of freedom of the robust tests, it indicates the relationships at hand (Sundet, 2007 personal communication).

The non-parametric test, Kruskal-Wallis, was applied whenever one of the groups had zero variance, due to zero frequency on the measures of concern. Kruskal-Wallis only imply that there is a significant difference in the rank order between the groups, and do not provide information of variances, standard errors or means.

All statistical tests were two-tailed and performed using SPSS 14.0

Results

Overall Conversational Patterns

Child utterances

Table 5 shows language measures for the three groups of children. Total utterances, percent of intelligibility and mean length of utterances in words (MLUw), indicated the relative complexity and amount of language produced by the children. In addition the mean frequency of child utterances that were partly or completely unintelligible or involved either grammatical or phonological errors and that preceded maternal utterances were calculated.

The Diagnosis and Suspected group differed significantly from the Control group on four language measures. They had significantly lower MLU [$F(2, 42)=19.8, p<.01$] and percent of intelligible speech [$F(2, 24)=34.0, p<.01$]. The effect sizes (η^2) of .49 and .60. were considered high (Cohen, 1988). The Diagnosis and Suspected groups also had significantly more partly and completely unintelligible utterances than the comparison group [$F(2, 42)=9.9, p<.01$; $F(2, 23)=13.6, p<.01$], ($\eta^2=.32$ and .42). The Diagnosis Group had fewer total utterances than the two other groups, but this difference did not reach significance. All groups had similar rates of utterances with grammatical errors, while the Diagnosis and Suspected groups had more utterances with phonological errors than the Comparison group.

Table 5: *Child utterances: mean frequency, standard deviation and range*

	<u>Diagnosis LD (N=16)</u>			<u>Suspected LD (N=7)</u>			<u>Control (N=22)</u>			<u>ANOVA</u>	
	M	(SD)	Range	M	(SD)	Range	M	(SD)	Range	F	P-H ^a
Total utterances	78.3	(29.00)	13-121	99.4	(34.50)	53-134	95.6	(25.09)	44-136	2.219	
% Intelligible	74.4	(11.65)	57-99	79.9	(4.53)	73-87	94.6	(4.87)	86-100	30.006**	DS<C ^b
MLUw	1.7	(0.32)	1.1-2.2	2.0	(0.60)	1.3-3.2	2.8	(0.62)	1.5-4.3	19.812**	DS<C
Targeted utterances											
^c Part. Unint.	5.6	(3.98)	0-13	9.1	(5.40)	3-19	2.4	(2.68)	0-10	9.938**	DS<C
^d Com. Unint.	8.9	(6.58)	0-23	6.3	(4.07)	0-11	1.1	(2.06)	0-9	13.594**	DS<C
^e Gram. Error	4.6	(4.47)	0-15	5.9	(5.01)	1-15	4.1	(2.34)	1-10	0.426	
^f Phon. Error	10.7	(7.79)	3-31	9.6	(3.55)	4-15	5.7	(8.71)	0-32	2.044	

** $p<.05$ df adjusted when the assumption of homogeneity of variance was violated.

Notes: ^a P-H = Tukey post-hoc comparison test

^b DS<C = The Diagnosis LD (D) and Suspected LD (S) are significantly lower than the Control group (C)

^c Part. Unint. = Partly unintelligible utterances

^d Com. Unint. = Completely unintelligible utterances

^e Gram. Error = Intelligible utterances with grammatical or syntactical error

^f Phon. Error. = Intelligible utterances with phonological error

Maternal responses to child utterances

Table 6 presents frequencies of total maternal utterances and maternal utterances following child utterances (Child-Mother sequences; *C-M*). *C-M* was the basis for the coding process and all estimations of maternal responses. The table also contains estimations of frequency and percentage of *C-M* for the main categories of maternal responses (elaboration, topic continuation, new initiative and other). Estimations of percentages of total child-mother sequences for the subcategories of elaboration (interpretation, recast, imitation and clarifying question) and topic continuation (continuation, question yes-no question and repetition) are also presented. (For frequencies of the subcategories see Appendix 3).

Mothers of children with Suspected LD and comparison children produced on average more utterances than did mothers in the Diagnosis group. The Diagnosis group also had fewest child-mother sequences, reflecting the lower average of total child utterances in this group reported above. These differences did not reach significance.

All mothers were equally likely to respond in contingency with the topic of previous child utterances. When calculating the percentage sum for together, all groups of mothers responded with either elaboration or topic continuation in more than 80 percent of the *C-M* sequences. The mothers in the Suspected LD group responded only slightly more (85.4 %) than mothers of children with a diagnosis or with normal language (i.e. 83.2 and 83.1 %). All the mothers initiated new topics and produced other child utterances at similar low frequencies and percentages. Such utterances constituted between 15-17 percent of the maternal responses.

The mothers of children with a LD diagnosis did however, interpret their children's utterances at a significant higher percentage of the *C-M* sequences, than the mothers in the control group [$F(4, 26)=4.2, p<.05$]. The effect size of .14 is classified as high according to Cohen's criteria (1988).

Even if all mothers showed similar patterns of responses, the mothers in the Suspected group showed a non-significant tendency for elaborating their children's utterances at a higher percentage (32.7 %) compared to mothers of children with a LD diagnosis (26.4 %) and normal language (24.1 %). When elaborating their children's utterances, they especially responded with more recasts than did the other groups of mothers. The mothers in the Diagnosis (56.8 %) and Control group (59.0 %) tended on the other hand to respond with topic continuations more than did the mothers in the Suspected group (52.7 %).

Table 6: *Maternal responses to child utterances: Frequencies and percentages*

	<u>Diagnosis LD (N=16)</u>			<u>Suspected LD (N=7)</u>			<u>Control (N=22)</u>			<u>ANOVA</u>
	M	(SD)	Range	M	(SD)	Range	M	(SD)	Range	<i>F</i> ^a
Total utterances F	153.1	(24.63)	112-193	159.9	(54.76)	87-243	158.7	(36.91)	92-237	0.140
Child-Mother F	71.4	(24.89)	21-117	87.0	(29.95)	42-120	81.4	(18.68)	44-111	1.428
Elaboration F	18.4	(8.10)	4-35	28.7	(15.66)	16-51	19.5	(8.14)	7-35	1.985
% Interpretation	3.5	(2.89)	0-10	1.9	(0.78)	1-3	1.7	(1.73)	0-5	4.199*
% Recast	13.9	(6.28)	5-24	17.7	(6.92)	9-26	13.0	(6.74)	1-29	1.316
% Imitation	3.4	(3.00)	0-10	6.3	(4.22)	0-14	4.9	(2.87)	0-12	2.221
% Clarifying Q.	5.6	(3.93)	0-15	6.8	(3.27)	2-12	4.5	(3.81)	0-14	1.013
Total % Elaboration	26.4	(9.55)	13-48	32.7	(10.77)	18-49	24.1	(8.35)	7-42	1.317
Topic Contin. F	41.8	(19.51)	11-87	46.0	(19.69)	20-81	48.1	(13.84)	28-78	0.630
% Continuation	41.1	(9.18)	27-56	40.1	(12.06)	22-60	45.4	(9.21)	32-73	1.334
% Question	5.4	(3.74)	0-14	3.5	(2.69)	2-6	3.8	(3.73)	0-14	1.210
% Yes-No Que.	7.5	(3.91)	0-14	7.4	(5.04)	2-16	7.8	(4.61)	2-21	0.027
% Repetition	2.7	(3.18)	0-12	1.7	(1.44)	0-4	2.0	(2.47)	0-12	0.544
Total % Topic Cont.	56.8	(9.08)	40-74	52.7	(11.54)	37-70	59.0	(7.91)	46-76	1.433
Initiative F	7.1	(3.38)	0-12	7.4	(1.51)	5-9	8.8	(4.45)	0-15	1.516
Total % Initiative	10.9	(5.54)	0-19	9.3	(2.96)	6-14	10.8	(5.07)	0-21	0.286
Other F	4.1	(3.42)	0-11	4.9	(2.41)	0-7	5.1	(3.47)	0-12	0.420
Total % Other	6.0	(4.49)	0-14	5.4	(2.83)	0-8	6.1	(3.46)	0-13	0.095

* $p < .05$ level with adjusted df due to violation of the assumption of homogeneity of variance,

Note: F = frequency estimations. % = percentage of total child-mother sequences

^a D>C = Diagnosis LD (D) have significantly higher means than Control (C)

Relation between specified language difficulties and maternal elaboration

As seen in figure 1, a two-way ANOVA revealed that there was a main effect of expressive language difficulties on the frequency of maternal elaboration [$F(2, 39)=3.3, p<.05$], with a large effect size (partial eta squared) of .15. This was caused by the fact that mothers of children with Suspected LD showed significantly higher levels of elaboration if their children's had mild expressive difficulties [$F(1, 39)=10.6, p<.01$] as opposed to phonological difficulties. The effect size of this interaction effect was large (partial eta squared = .17).

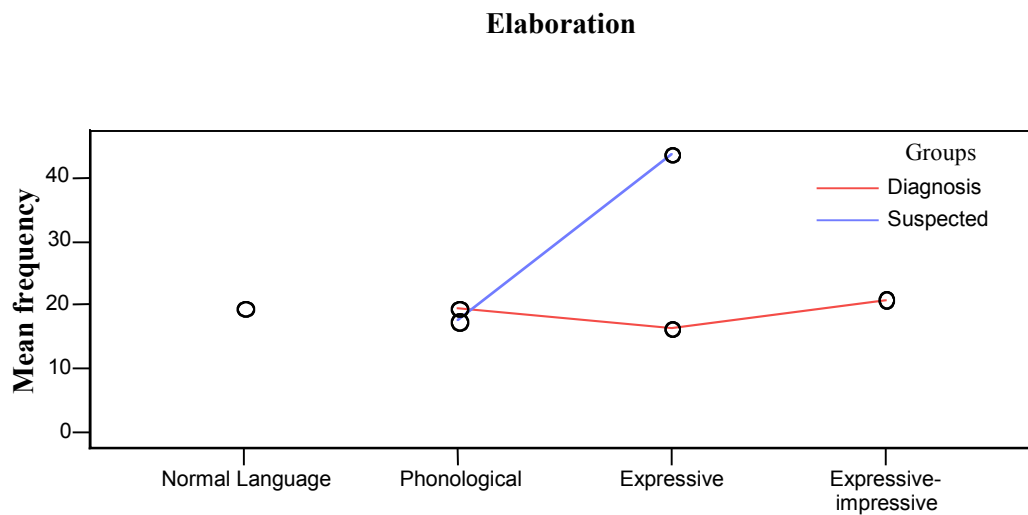


Figure 1: Interaction effect between group and specified language difficulties on maternal elaboration.

Maternal Responses to Different Child Utterances

The different maternal responses to child utterances that either was partly or completely unintelligible or contained grammatical or phonological errors are presented in table 7. No comparison reached significance, even though some patterns occurred. The table also includes the total frequency of the different types of child utterances that was reported in table 5.

Table 7: *Frequencies of child utterances and percentages of maternal responses*

	<u>Diagnosis LD (N=16)</u>			<u>Suspected LD (N=7)</u>			<u>Control (N=22)</u>			<u>ANOVA</u>
	M	(SD)	Range	M	(SD)	Range	M	(SD)	Range	<i>F</i> ^a
Part. Unint.	5.6	(3.98)	0-13	9.1	(5.40)	3-19	2.4	(2.68)	0-10	9.938**
% Elaboration	31.0	(33.38)	0-100	44.1	(19.23)	14-75	28.3	(34.08)	0-100	0.626
% Topic cont.	57.2	(32.19)	0-100	33.2	(17.18)	0-57	49.2	(39.30)	0-100	1.182
% Initiative	6.9	(11.80)	0-40	17.9	(10.80)	0-33	14.1	(19.98)	0-50	1.687
% Other	4.9	(9.11)	0-29	4.8	(6.25)	0-14	8.4	(25.00)	0-100	0.187
Comp. Unint.	8.9	(6.58)	0-23	6.3	(4.07)	0-11	1.1	(2.06)	0-9	13.594**
% Elaboration	26.9	(16.91)	0-60	26.4	(37.65)	0-100	4.2	(11.79)	0-33	3.181
% Topic cont.	51.6	(21.69)	0-80	58.3	(33.93)	0-100	42.4	(32.39)	0-100	0.604
% Initiative	17.7	(15.43)	0-43	8.3	(12.88)	0-27	43.1	(40.36)	0-100	3.469
% Other	3.9	(6.58)	0-20	7.0	(8.36)	0-20	10.4	(19.80)	0-50	0.630
Gram. Error	4.6	(4.47)	0-15	5.9	(5.01)	1-15	4.1	(2.34)	1-10	0.426
% Elaboration	36.9	(29.71)	0-100	47.0	(39.76)	0-100	33.1	(31.99)	0-100	0.483
% Topic cont.	58.6	(30.15)	0-100	53.0	(39.76)	0-100	59.5	(32.17)	0-100	0.106
% Initiative	4.4	(9.81)	0-33	0.0	(0.00)	0-0	7.4	(11.81)	0-33	2.771
% Other	0.0	(0.00)	0-0	0.0	(0.00)	0-0	0.0	(0.00)	0-0	-
Phon. Error	10.7	(7.79)	3-31	9.6	(3.55)	4-15	5.7	(8.71)	0-32	2.044
% Elaboration	42.8	(23.02)	20-100	41.7	(22.58)	13-75	36.1	(27.29)	0-100	0.328
% Topic cont.	40.2	(19.90)	0-74	48.8	(30.68)	0-88	57.1	(27.26)	0-100	1.908
% Initiative	10.5	(10.86)	0-20	6.2	(9.34)	0-25	5.0	(9.37)	0-33	1.333
% Other	6.6	(10.15)	0-22	3.3	(5.90)	0-14	1.7	(5.89)	0-25	1.786

**<.01, df was adjusted when violation of the assumption of homogeneity of variance occurred.

Note: When one group had zero variance, Kruskal-Wallis was applied.

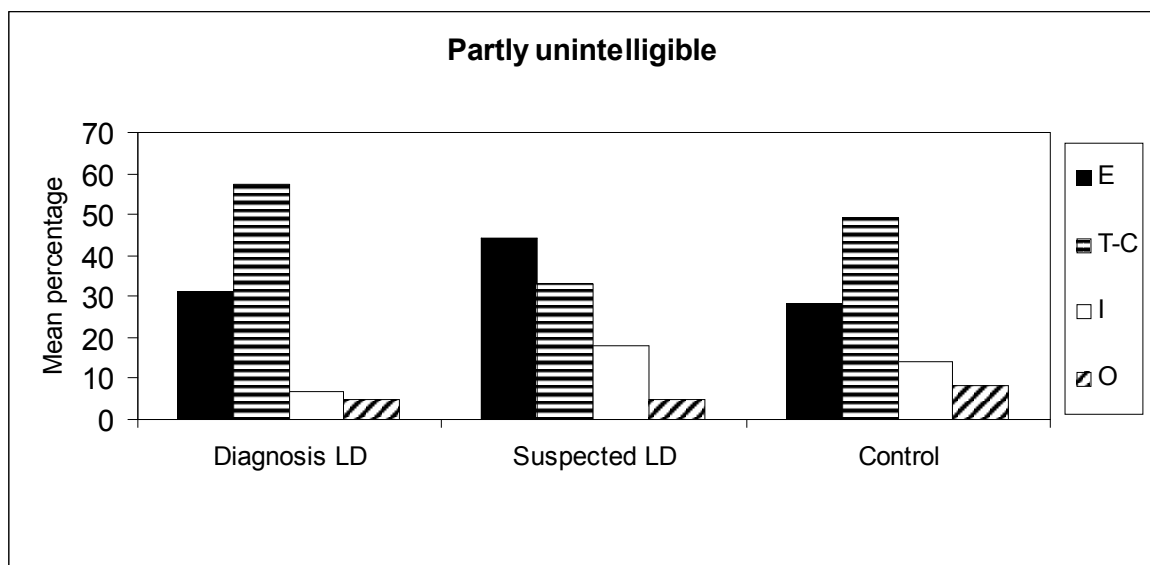
^a For group comparison, see table 5.

Partly unintelligible child utterances

As indicated in table 7 and figure 2, an ANOVA showed that when responding to partly unintelligible child utterances, the groups of mothers did not significantly differ in their

tendencies to elaborate, continue on the same topic or initiate new topics. All the mothers showed high rates of responses in total (i.e. the sum of elaboration and topic continuation).

Still, the mothers in the Suspected group elaborated in 44.1 percent of their responses to partly unintelligible child utterances, compared to 31.0 and 28.3 percent for the mothers in the Diagnosis and Control groups. The mothers in the Diagnosis and Control group responded with topic continuation more often compared to the mothers in the Suspected group. Mothers of children with a language disorder diagnosis did not initiate new topics as often as did the other mothers. None of these differences reached statistical significance.

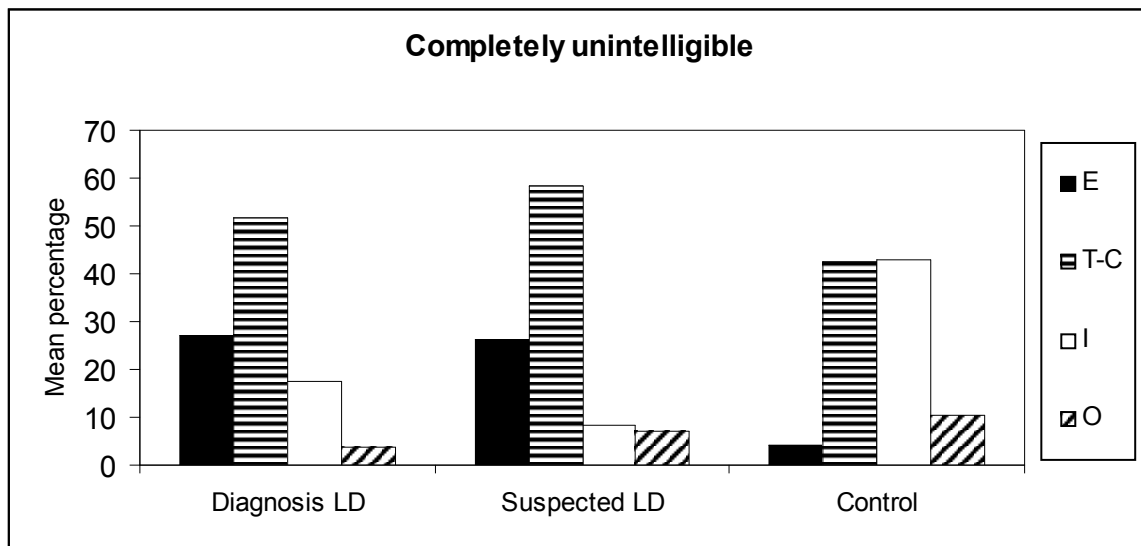


E = Elaboration, T-C= Topic Continuation, I= Initiative, O= Other

Figure 2: Maternal responses to partly unintelligible child utterances.

Completely unintelligible child utterances

There was a strong tendency for the mothers in the Diagnosis and Suspected groups to elaborate or continue on the same topic when responding to completely unintelligible child utterances (i.e. interpretation or clarifying question) (table 7 and figure 3). These mothers elaborated more often than the mothers in the Control group, which approached significance [$F(2, 26)=3.2, p=.058$]. Contrary, mothers in the Control group tended to initiate new topics more than the mothers in the other groups following completely unintelligible child utterances, although this did not reach significance [$F(2, 10)=3.5, p=.072$].

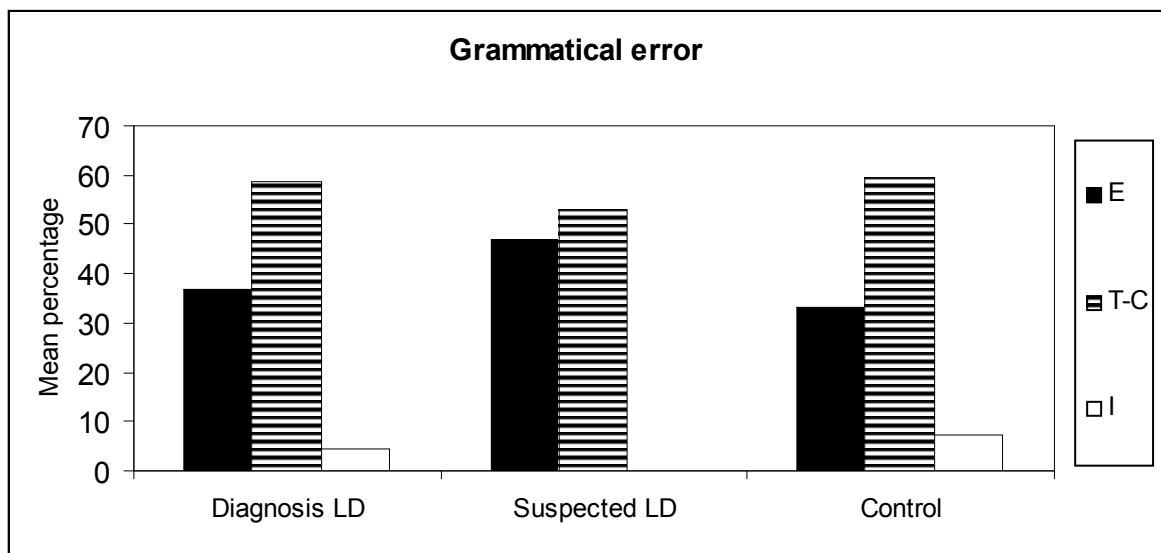


E = Elaboration, T-C= Topic Continuation, I= Initiative, O= Other

Figure 3: Maternal responses to completely unintelligible child utterances.

Child utterances with grammatical/ syntactical errors

Table 7 and figure 4, show maternal responses to child utterances with grammatical or syntactical errors. The mothers in all the groups either responded with elaboration or topic continuation between 92 and 100 percent of the instances when the children's previous utterances contained grammatical errors.



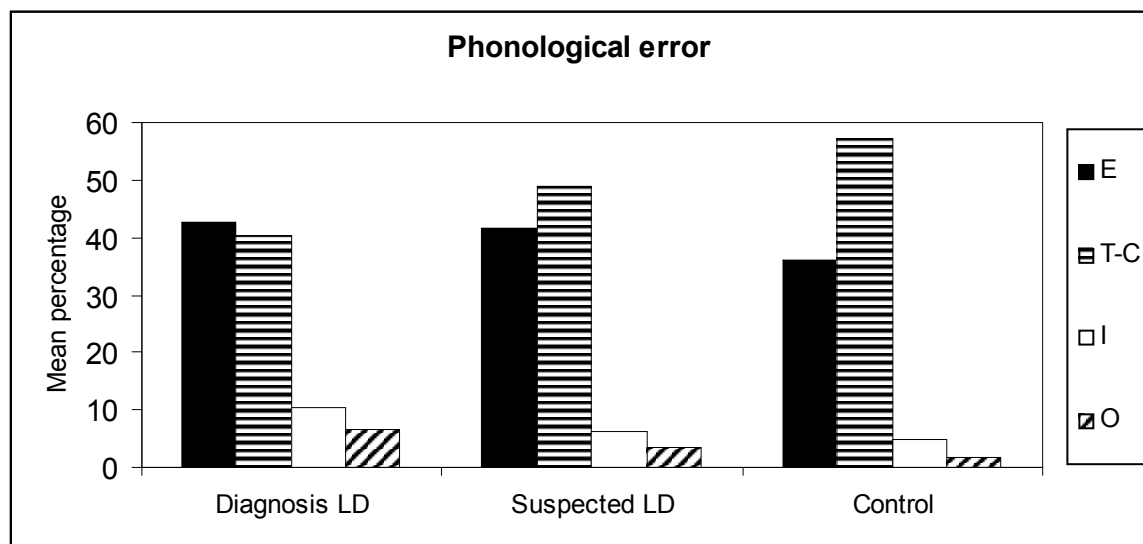
E = Elaboration, T-C= Topic Continuation, I= Initiative

Figure 4: Maternal responses to child utterances with grammatical errors.

Mothers in the Suspected group tended to elaborate slightly more of these child utterances (47.0 %) compared to 36.9 and 33.1 percent for the mothers in the Diagnosis and Control groups. While the mothers in the Control and Diagnosis group continued on the same topic more often than mothers in the Suspected group. These differences were not strong enough to reach statistical significance.

Child utterances with phonological errors

Table 7 and figure 5, show that the groups of mothers did not statistically differ on their responses to child utterances with phonological errors. The mothers in the Control group responded with either elaboration or topic continuation in 93.2 percent of the sequences and the mothers in the Suspected and Diagnosis group to 90.5 and 83.0 percent of the child utterances with phonological errors. The mothers in the Control group tended to respond with topic continuation more often, but did not significantly differ from the other groups. On the other hand, the mothers of children with a suspected LD or a LD diagnosis elaborated and initiated new topics slightly more.



E = Elaboration, T-C= Topic Continuation, I= Initiative, O= Other

Figure 5: Maternal responses to child utterances with phonological errors.

Correlation between child language and maternal replies

Table 8 presents the correlation between the four types of child utterances and the different maternal discourse replies. Pearson product-moment correlation coefficient is especially sensitive to small group sizes, which especially affect the correlation in the Suspected group. Based on the guidelines of Cohen (1988) non-significant correlation above .50 is however, considered noteworthy.

Maternal elaboration. High levels of partly unintelligible child utterances and child utterances with grammatical errors were significantly associated with high levels of maternal elaboration in total [$r=0.45$, $n=45$, $p<.01$; $r=0.33$, $n=45$, $p<.05$]. The exact same and strong relationships appeared in the Suspected group, but did not reach significance [$r=0.70$, $n=7$, $p=.08$; $r=0.53$, $n=7$, $p=.22$]. This reflects the non-significant tendencies for the mothers in the Suspected group to elaborate more of such child utterances, compared to the other groups. In the Diagnosis group however, maternal elaboration was positively and significantly related to completely unintelligible child utterances and utterances with phonological errors [$r=0.51$, $n=16$, $p<.05$; $r=0.66$, $n=16$, $p<.01$]. This support the fact that the mothers in the Diagnosis

Table 8: *Correlation between different types of child utterances and maternal responses*

	Elaboration	Topic Contin.	Initiatives	Other
Diagnosis LD (N=16)				
Partly Unintelligible	.17	.44	.68**	-.18
Completely Unintelligible	.51*	.50	.03	-.12
Grammatical Error	.32	.39	-.09	.24
Phonological Error	.66**	.62*	-.30	-.10
Suspected LD (N=7)				
Partly Unintelligible	.70	.31	.65	.16
Completely Unintelligible	.01	.53	-.08	.40
Grammatical Error	.53	.63	-.01	.21
Phonological Error	-.21	-.31	.41	.15
Control (N=22)				
Partly Unintelligible	.33	-.30	.10	-.07
Completely Unintelligible	.15	-.10	.08	-.11
Grammatical Error	.07	.52*	.21	.15
Phonological Error	.03	.04	.39	.06
Total (N=45)				
Partly Unintelligible	.45**	.10	.17	-.09
Completely Unintelligible	.20	.17	-.11	-.13
Grammatical Error	.33*	.45**	.02	.18
Phonological Error	.18	.19	.10	-.03

* $p<.05$; ** $p<.01$, 2-tailed. , Pearson product-moment correlation coefficient

group tended to especially elaborate such utterances at similar rates as the mothers in the Suspected group, even if not significantly different from the mothers in the Control group. The mothers in the Control group did not show such strong relationships between any of the utterance types and their level of elaboration.

Maternal topic continuation. In the total sample, high levels of maternal topic continuations was only positive and significant related to child utterances with grammatical errors [$r=0.45$, $n=45$, $p<.01$]. The same relationship did also occur in the Control group [$r=0.52$, $n=22$, $p<.05$]. In the Diagnosis group, all child utterances were positively related to maternal levels of topic continuation. However, high levels of utterances with phonological errors was significantly associated with high levels of maternal topic continuations [$r=0.62$, $n=16$, $p<.05$]. In the Suspected group, none of the child utterances significantly correlated with maternal topic continuation, but both high levels of child utterances with grammatical errors and completely unintelligible utterances was relatively strongly and positively related to topic continuations [$r=0.63$, $n=7$, $p=.13$; $r=0.53$, $n=7$, $p<.22$].

Maternal initiatives. Partly unintelligible child utterances did show a strong positive correlation with maternal initiations in the Diagnosis and Suspected group [$r=0.68$, $n=16$, $p<.01$; $r=0.65$, $n=7$, $p=.12$], but did only reach significance in the Diagnosis group. Even if the mothers in the Control group did show a non-significant tendency to initiate new topics following completely unintelligible child utterances, these variables did not correlate. In fact, there was a small negative, but non-significant correlation. This reflects that the children in the control group had few completely unintelligible utterances.

Discussion

Mothers of children with language delay responded to their children's utterances in a way similar to that of mothers of children with typical language. This suggests that the groups of mothers are equally attentive to the topics of their children's utterances. Still, there were tendencies of maternal adjustment to the differing characteristics of the language productions of the children. In the following sections the main finding of no particular difference between the groups, as well as the tendencies towards variations between them are discussed more thoroughly in relation to previous research results. Alternative explanations and implications for the children's language development are also discussed.

The Mothers Responded Proportionally Similar to their Children's Utterances*Topic continuity*

All three groups of mothers tended to continue on the topic of the child utterances rather than initiate a new topic. This occurred in around 85 percent of the child-mother sequences. Similar percentages were found in Rescorla et al. (2001) who compared mothers of late talkers, late bloomers and children with normal language at the age of three. Nelson and colleagues (1995) also reported equal percentages of topic contingent maternal responses when comparing older children with specific language impairments and younger children matched on MLU. An adjacent interpretation is that mothers of children with language delays adapt and compensate for the unintelligibility and lower complexity of their children's language. In this way the children are not deprived of reciprocal linguistic experiences where maternal utterances rely upon the topic of the child utterance. Even if children with language delay have less complex and shorter utterances compared to typical developing children, which leaves more conversational space for the mothers, the mothers do not use this extra time to initiate new topics (Rescorla et al., 2001). Topic contingency increases the saliency of the maternal input, which has been considered an important strategy for language acquisition, as this relieves the child's cognitive resources (Girolametto et al., 1999; 2002; Tomasello, 2003).

The results of the present study, however, differ from that of some other studies (Conti-Ramsden, 1990; Peterson and Sherrod, 1982; Vigil et al., 2005). Vigil et al. (2005) compared maternal responses to 2-year-old children with and without language delays. These researchers report that the mothers of children with language delay initiated more new topics and responded less often than the mothers of children with typical language. Two methodological aspects may explain these discrepancies. The children with language delay in the present study were older and therefore presumably produced more language. The children in the suspected and diagnosis groups had significantly lower scores on MLU and intelligibility of their speech compared to the children in the control group, but they did not differ significantly on the measures of total utterances or grammatical and phonological errors. The mothers of the present study therefore had more language to respond to, as well as more experience with the language disadvantages of their children than the mothers in Vigil et al. This may have made an impact on the high levels of contingency with the thematic content of the child utterances. Another explanation for the different results could be related to the focus on child-mother sequences of the present study, compared to the overall measure of

proportions of responses to child initiations in Vigil et al. (2005). The present study was directed at discovering the specific patterns between child language and the maternal utterances that follows. Even if controlling for the total language production of the children decreases the group differences (Paul and Elwood, 1991), it will not ensure which of the maternal utterances that are relatively compared. In the present study, the mothers were compared on how they reacted to children's utterances, rather than their relative distribution of initiatives and responses.

Elaboration

There were no significant differences in the total rates of maternal elaboration. All mothers seemed to elaborate on the content of the child utterances at comparable rates, even if the groups of children did have different complexity and quality in their language productions.

The only significant difference between the sub-categories was that the mothers of children with a language disorder diagnosis interpreted their children's utterances proportionally more often than the mothers of the children in the control group. This may reflect that these children had more unintelligible utterances that needed to be interpreted than the other groups. Such an interpretation of the results is supported by the fact that unintelligibility of child utterances was significantly related to frequency of maternal elaboration in this group.

Mothers of children with a suspected language disorder, however, did not interpret at a similar rate. The children with a language disorder produced more completely unintelligible utterances, while children in the suspected group had more partly unintelligible utterances. Thus, since the children in the suspected group had more utterances with parts that could be understood by their mothers, the mothers in this group may have leaned on other elaborating strategies when responding to their children's utterances. Facilitating effects of maternal interpretations on child language development have influenced the application of such strategies in interventions (Girolametto et al., 2002). The results of the present study suggest that maternal interpretation may be a natural reflection of the unintelligibility of child utterances.

Discrepancies in maternal use of recasts (i.e. addition of word(s) or morpheme(s) and structural reordering, expansion or reduction of child utterance), in particular, have been found when comparing mothers of children with and without language delays (Conti-Ramsden, 1990; Conti-Ramsden et al., 1995; Nelson et al., 1995). Such a *recast gap* was not

evident in the present study. In accordance with other studies that have used same-aged control groups, no significant group difference was found in the percentages of maternal recasts (Fey et al., 1999; Paul and Elwood, 1991). There was however, a non-significant and rather unexpected tendency for the mothers of children with a suspected expressive language disorder to elaborate their children's utterances proportionally more often than the other two groups of mothers. They especially used recasts at a higher rate than the other mothers did, even if the groups did not differ significantly.

Because maternal tendencies to use recast in conversation with their children do not seem to differ when comparing children on chronological age and general cognitive level, Nelson et al. (1995) argue that mothers adjust their recasts not to the language level but to the known mental age of their children. In the present study, children in the suspected and diagnosis groups had significantly lower mental ages compared to the children in the control group. As there were few differences between the mothers, a further investigation of the effects of mental age was not carried out. The children's cognitive level of functioning may possibly have influenced the proportion of recasts made by the mothers of the children with suspected expressive LD. Still, this does not explain why the mothers of the children with a language disorder diagnosis did not recast more, considering that this group had lowest IQ scores.

The particularly high levels of maternal elaboration by mothers of children with suspected language disorder indicated that there was something about the expressive language delay in this group that triggered maternal recasts. It may seem like this group of children had a systematic enhanced intelligibility and complexity in their speech compared to the children with a diagnosis. The suspected group had slightly more partly unintelligible utterances, less completely unintelligible utterances and a somewhat higher MLU compared to the diagnosis group. In a study that only included children with language delay (Yoder et al., 1997), maternal recasts (i.e. expansions) was positively related to intelligibility and utterance length of the children. In the present study, there was a moderate, but non-significant relation between maternal elaboration in the Suspected LD group and both partly unintelligible child utterances and utterances with grammatical errors. It is possible that it was the combination of a certain degree of unintelligibility and a certain degree of need for correction in the children's speech that elicited relatively higher levels of maternal elaboration. In any instance, both the present study and the study of Yoder et al. (1997) show that it was the least affected children that received the most recasts.

In contrast to the indications of a relationship between maternal elaboration and both utterance length and partly intelligibility in the present study, Yoder et al found a relationship between the multiword fully intelligible utterances and maternal recasts. This may be related to the estimations of sequential dependencies in Yoder et al, which differ from the exact sequential relationships examined in the present study. On the other hand, the present study did not measure the recast rates following the various child utterances, but chose instead to focus on the main category of elaboration. Examining the subcategories of elaboration could have revealed that mothers of children with a suspected language disorder elaborated in other ways than recasting when responding to partly unintelligible child utterances.

The Type of Utterances did not affect the Maternal Responses Profoundly

The children with suspected LD or a LD diagnosis spoke less intelligible and had somewhat more intelligible utterances with phonological errors than the children in the Control group. This supports the fact that the groups had different conversational preconditions. When comparing maternal responses to the four different types of child utterances, all groups of mothers, nevertheless, responded highly synchronous with the topic in the child utterances. This is in accordance with other studies which found that mothers of children with language delays do respond rather than initiate new topics at equal rates as mothers of children with normal language (Fey et al., 1999; Nelson et al., 1995; Rescorla et al., 2001). Even if these studies measured the overall pattern of maternal responses, without considering the temporal relationship between different types of child utterances and maternal response, the studies complements the present on the notion that the mothers respond in similar ways when responding to the same type of child utterances.

In any case, the mothers of children with diagnosed and suspected language disorder tended to either respond with elaboration or topic continuation when reacting to completely unintelligible utterances. Mothers of children with normal language, on the other hand, either changed topic or continued without elaborating on the unintelligibility of the child utterances. There was no correlation between maternal initiatives and completely unintelligible utterances in the control group, which reflect that these children produced few such utterances.

Due to the fact that the mothers either interpreted or asked clarifying questions about the content of the child utterance when responding with elaboration to completely unintelligible utterances, the results suggests that child unintelligibility elicit such responses.

Yont et al (2002) also found a relation between unintelligibility and maternal clarifying requests. That is, these researchers looked for child utterances that resulted in conversational breakdowns, whereby the mothers asked for their children to clarify what they had intended to say. Consequently the researchers also found that unintelligible and other child utterances led to maternal clarifications. The present study complements by showing how completely unintelligible child utterances elicit maternal requests for clarifications.

In contrast to the connection between (partly) intelligibility and maternal use of recasts (Conti-Ramsden, 1990; Yoder et al., 1997), child unintelligibility seems to be a natural antecedent of maternal interpretations and clarifying questions. The role of recast in directing error-prone child utterances depends upon the fact that at least parts of the child utterance are comprehensible (Conti-Ramsden, 1994). The use of elaborating maternal responses like interpretation and clarifications do not rely upon intelligibility, but nevertheless provide the children with responses that inform of the difficulties with comprehension that the mothers experience. This might be facilitating, if the children take the feedback into consideration and reproduce their intended messages in an improved form (Pine, 1994).

There might be several reasons why the mothers of the children with suspected or diagnosed language disorders do elaborate more when replying to unintelligible child utterances compared to the Control group. One possible explanation might be experience. That is, the children in the Suspected and Diagnosis group did produce on average between six and nine completely unintelligible utterances, as compared with only one for the comparison children. The relatively inexperienced mothers in the control group, may not have developed strategies to overcome unintelligible child utterances or may not be as conscious about their facilitating role as conversational partners as the mothers of children with language delays. Yoder et al. (1996) made a similar account when mothers of children with Down's syndrome responded with recasts to partly unintelligible child utterances more often than mothers of children with language delays. That is, since the children with Down syndrome were older and produced more partially unintelligible utterances, their mothers were more experienced in interpreting and building on such utterances.

In the present study, unintelligibility was defined as utterances that were either completely or partly unintelligible to the transcribers. As a consequence of having more experience with unintelligible child utterances, the mothers of children with suspected LD or a LD diagnosis might also understand more of their children's speech than the transcribers. This may have affected the slightly higher rates of topic continuations compared to mothers in the control group. This does not, however, call in question the decisions of unintelligibility by

the transcribers, since both the maternal responses, interpretation and clarifying request, do indicate that there are parts of the speech that the mothers do not understand (Saxton et al., 2005; Yont et al., 2002).

Few studies have been directed at detecting sequential relationships between child utterances and maternal responses. The present study indicate that mothers usually respond similarly to the same child utterances, but that mothers of children with language delay naturally adjust to the less intelligible speech of their children.

Limitations

All population-based studies face the problem of biased participation. There exist a probability that mothers with high socio-economic status agree to take part in studies. The relatively high educational levels of the groups of mothers in the present study reflect this. Thus, cautions should be made to generalize to populations with low socio-economic status. Another related implication is the constructed unnatural “laboratory” setting compared to the home environment. Some studies show, however, that mothers of children with and without language delays are not considerably affected by this (Bornstein et al., 2000).

The co-morbidity diagnosis of expressive-impressive language disorder and attention hyperactivity disorders in three of the children in the Diagnosis group could have made it even more difficult for these mothers to follow the focus and content of the child utterances. On the other hand, co-morbidity between language impairment and attention problems is not limited to the present study (Hick, Botting and Conti-Ramsden, 2005).

Another possible limitation of the study is the relatively low reliability on the maternal interpretation and initiative codes. The reliability of elaboration and initiation would probably increase with longer transcripts and more child-mother sequences to code, in addition to more time and resources on consensus discussions. In any instance, the present study only took advantage of the transcripts coded by the author, so the limitation would in any instance be a structural one.

Most studies in this research include small sample groups (Conti-Ramsen, 1990; Nelson et al., 1995; Vigil et al., 2005; Yont et al; 2002), due to the amount of time it takes to transcribe, code and reach acceptable levels of inter-rater agreement on the codes. The present study is not a small-scaled study in this regard, but the relatively few dyads included in the Suspected group made it especially difficult to detect any differences between this group and

the other two groups. Increasing the number of children in the Suspected group could result in the same tendencies, but with higher statistical strength.

Implications for the Development of the Language Disordered Children

The present results show that despite the different language productions of the groups of children, the mothers of both children with and without language delays responded similarly to the child language productions when first responding. This is in contrast to the hypothesis of an “*inadequate feedback-loop*” (Tannock and Girolametto, 1992 in Vigil et al., 2005). The language delays were not related to lower degrees of maternal responses. In fact, the mothers of the children with language delays showed a tendency to be especially sensitive to child unintelligibility.

Considering the need to catch up with normal developing peers, some researchers suggest that “normal” rates of maternal responses may not be enough to compensate for the children’s language delays (Camarata and Yoder, 2002; Evans, 2001; Fey and Proctor-Williams, 2000; Evans, 2001). The facilitating effects of recast interventions when applying them at a higher rate than what seems to occur in natural interactions, suggests that children with language impairment have special linguistic input needs (Fey, Krulik, Loeb and Proctor-Williams, 1999). In fact, Fey and Proctor-Williams (2000) calculated that the children who gained the most over an 8 months period (Fey et al., 1999), received twice the recast rate than what is common in dyads with typical children. From such a perspective, the lack of group differences in the present study may not be optimal in isolation if the children with suspected language delay or with a language delay diagnosis are to catch up with their peers during their preschool years.

Borrowing the term feedback systems from transactional theory (Sameroff and MacKenzie, 2003), children with normal language and their mothers can be considered to form “ordinary feedback systems”. In such interdependent systems, the mothers presumably fulfil the input needs of their children in a natural and unnoticeable way. Contrary, mothers of children with language delay could reduce or amplify the effects of impairments through child-mother interactions over time. In light of the positive effects of increased rates of maternal recasts, the mothers in the present study could implement a “*positive feedback system*” with their children (Sameroff and MacKenzie, 2003).

The tendency to elaborate more of the unintelligible child utterances could have a positive effect on later language outcomes for these children. The weak statistical strength however suggests that the between-group variance may not be big enough to make a difference on the children's language development.

The present study indicated that the intermediate levels of unintelligibility, utterance length and grammatical complexity in the suspected group could function as "eliciting bootstrapping operations" for the increased levels of maternal elaboration (Shatz, 1987 in Yoder et al., 1997). Similarly, the higher levels of completely unintelligible speech of the children in the diagnosis group could elicit maternal interpretation and requests for clarification. Furthermore these tendencies occur naturally in play interactions, which could mean that the present study have revealed patterns in conversations of children with varying degrees of language delay, which are interdependent on the preceding child language productions and the following maternal reactions (Camarata and Yoder, 2002). This is noteworthy, because it indicates that the mothers in the present study adjust to and compensates for the language disabilities of their children, by being especially responsive to the different degrees of unintelligibility of their children.

Future follow-up studies of the groups of children and mothers could provide answers to many questions. Are these tendencies evident at later stages in development? Do the different conversational patterns have any effects on the children's language gains over time? A follow-up study could even indicate whether the patterns of concern influence why some of the children will develop into more prolonged and severe specific language impairment problematic and others would have more transient language difficulties (Dale, Price, Bishop, Plomin, 2003).

Early identification, not just of the delays or impairments, but also of the nature of the children's functioning and their interplay with their families is important in order to understand how to regulate the surroundings in the most efficient way (Rutter, 2000). Or as Sameroff and MacKenzie (2003) highlighted on a more general basis, it is relevant to understand where improvements can be made before seeking to improve. Conti-Ramsden (1994) pointed out early that language-input needs of children with language impairments could be different from what is natural and functional in the normal population. Special children could end up having special needs (Conti-Ramsden, 1994), and it is a respectable research aim to find out how the dyads affect each other and why, before one seeks to change the interaction patterns through interventions (Rutter, 2000).

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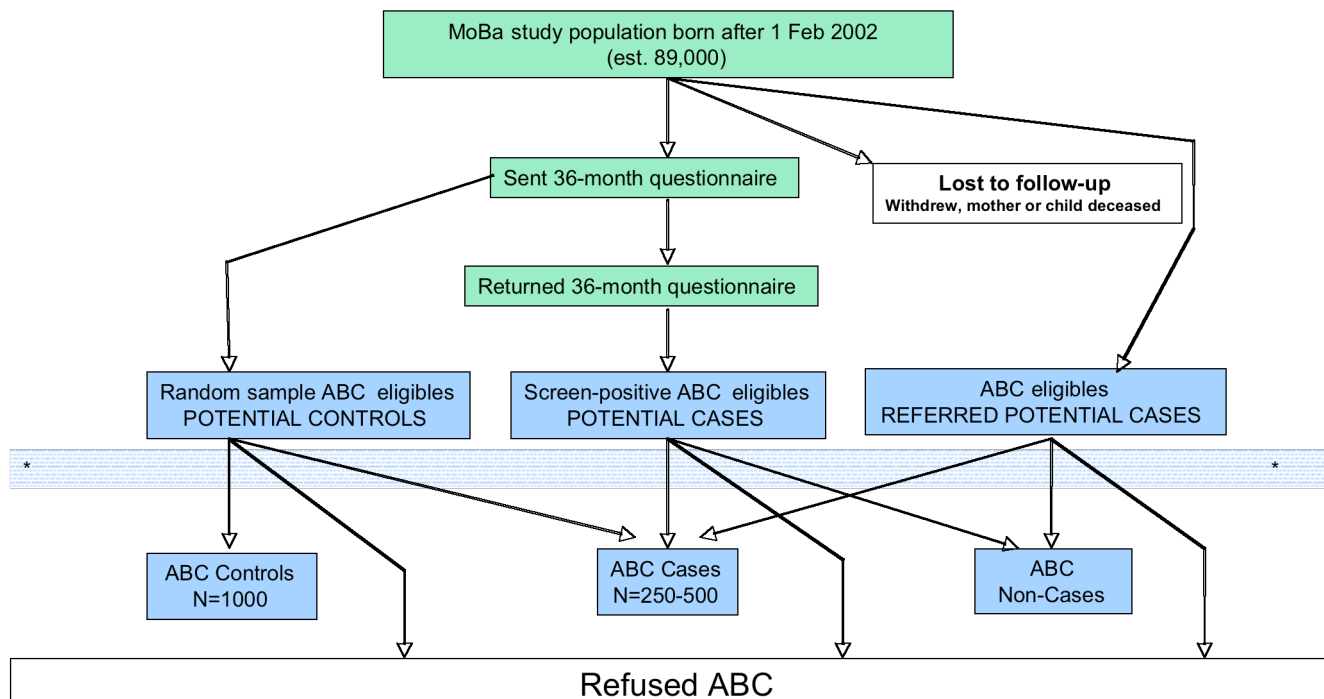
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Appendix 1



Note: The figure show how the case- and control- children in the ABC study are derived from the MoBa sample through the 36-month questionnaire (Revised protocol in the ABC study, May 2006). The numbers are estimates of the final size of the ABC study. Children that screen positive at 36-month are invited to participate in the ABC study. The controls are randomly selected from the same questionnaire. In addition, some families do initially say no to participate or have not returned the 36-month questionnaire, but are later referred to the ABC study as potential cases.

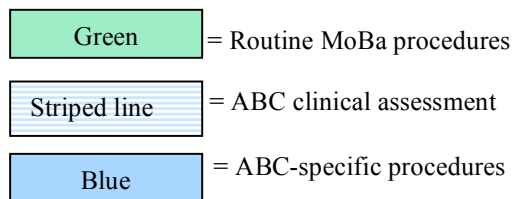
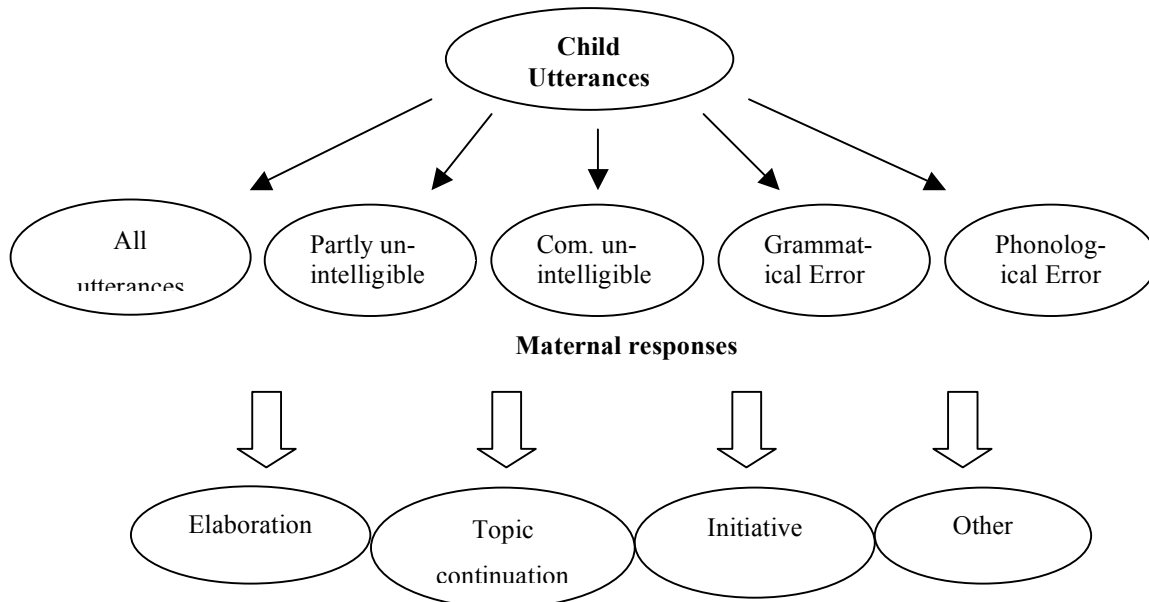


Figure 1. Nesting of the ABC in the MoBa Study Cohort.

Appendix 2



Note: Visualization of the child-mother sequences included in the present study. All child utterances that preceded a maternal utterance were included for analysis. Child utterances that were partly, or completely unintelligible, as well as those utterances that had grammatical/syntactical or phonological errors were also targeted. Maternal responses were divided into elaboration, topic continuation, initiative and other.

Figure. Framework of selected child-mother sequences in the present study

Appendix 3

Table: *Maternal responses: frequencies of subcategories*

	<u>Diagnosis LD (N=16)</u>			<u>Suspected LD (N=7)</u>			<u>Control (N=22)</u>			<u>ANOVA</u>
	M	(SD)	R	M	(SD)	R	M	(SD)	R	<i>F</i> a
Elaboration										
Interpretation	2.3	(2.18)	0-7	1.7	(1.11)	1-4	1.4	(1.47)	0-5	1.415
Recast	10.1	(5.46)	1-20	15.3	(8.34)	6-29	10.6	(5.82)	1-24	1.939
Imitation	2.4	(1.71)	0-6	5.4	(4.53)	0-14	3.9	(2.05)	0-7	4.170*
Clarifying Que.	3.7	(2.52)	0-9	5.7	(3.55)	2-12	3.7	(2.95)	0-11	1.447
Topic Continuation										
Continuation	30.5	(15.12)	7-66	35.0	(18.01)	16-70	37.0	(12.42)	22-73	0.962
Question	4.4	(4.29)	0-14	2.9	(1.68)	1-6	3.4	(3.83)	0-16	0.493
Yes-No Question	4.9	(2.49)	0-10	6.6	(4.28)	0-13	6.0	(3.54)	2-19	0.723
Repetition	2.0	(2.16)	0-7	1.6	(1.72)	0-5	1.7	(2.08)	0-8	0.152

* $p < .05$ level with df of 2 and 43. Adjusted df following violation of the assumption of homogeneity of variance.

Note: M = mean, SD = Standard deviation, R = Range

a Mothers in the Suspected group imitated significantly more often than the mothers in the Diagnosis group.